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FIRE PRESSURE

BY CHARLES R. HENDERSON¹

There seems to be no good reason why the dangerous and wasteful practice of increasing pressure on hundreds of miles of water mains, every time there is an alarm of fire, should be continued. It was at one time the best method, especially in small towns where a pressure adequate for fire streams was not necessary for domestic supply and the domestic pressure was not adequate for fire streams. Mains then were small, hydrants were far apart, fire departments were manned by volunteers, steam fire engines were expensive to install and expensive to keep in readiness for service, requiring additional horses and one or more skilled mechanics to operate the engines.

Conditions have changed. The automobile has revolutionized fire departments as well as many other things. Now the same vehicle that carries the hose, the men and the tools, to the fire, is also the fire engine when a small and inexpensive pump is added to the apparatus. The driver of the automobile apparatus is also the "engineer" and "fireman" of the pumper.

Some cities are already giving up the practice of raising pressure in the mains as the fire departments acquire pumbers. Why?

In one city requiring all service pipes to be of lead, one-half of all the 2-inch lead services in use have ruptured, and the reason given is the stretching of the walls of the pipe due to frequent increase of pressure. Plumbing is without doubt seriously damaged by change of pressure. Elevated storage reservoirs which serve as equalizers to the pumping rate must be shut off from the distribution system when direct pumping beyond the head produced by the height of the reservoir is required. This seems to be very bad practice, requiring strain and a dangerously high rate of pumping during some fire alarms, which occur at times of heavy domestic consumption.

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In some cities, mains, of twelve inches diameter and over, have burst during time of carrying fire pressure, virtually putting the water department out of business until such mains were shut off. It sometimes happens that in changing the adjustment of the steam valves on a large pumping engine, to effect a change of water pressure, the pumping engine is accidentally shut down. The writer saw one accident of this kind which resulted in a city of 50,000 population being entirely out of water for nearly half an hour. If there is any time when conditions in the pumping stations should be more free from the danger of accidents than any other time, it is when there is a fire. Increasing pressure for fires is the cause of strain, excitement and, often, accidents that tend to cripple the water department.

A pressure of 60 pounds (138 feet) will supply all but very high buildings with a satisfactory supply for domestic purposes without re-pumping at the building; then, if the mains are of proper size, the fire department can obtain enough water for any fire at good pressure. Such a pressure is ample for automatic sprinklers and is enough for small fires requiring one or two lines of hose.

Ordinarily, firemen do not require more than 40 to 45 pounds pressure at the base of the nozzle. Large fires require more pressure than any ordinary water works can safely carry, because to lay many lines of hose requires some very long lines. Large nozzles require either more than one line of hose to supply them or else high velocities in the hose line and that requires high pressure at the hydrant. Powerful streams require more than 45 pounds at the nozzle.

It should be the duty of the water department to furnish the water in sufficient quantity at ordinary pressures suitable for good domestic service and all higher pressures required should be provided by the fire department using pumper or fire engines.

The table herewith presented has been prepared from the answers to inquiries sent out to the 143 cities in the United States, having a population of more than 50,000 according to the census of 1920. This table shows that domestic pressures in commercial districts range from 20 pounds to 145 pounds per square inch. Domestic pressures in residential districts range from 25 pounds to 125 pounds. The average reported pressure is, in commercial districts, 68 pounds and in residential districts 56 pounds. Not more than 25 per cent of the cities raise pressure at time of fire.

Table of water pressure in 143 United States cities

CITY	NORMAL PRESSURE POUNDS PER SQUARE INCH		PRESSURE INCREASED FOR FIRE
	Commercial district	Residence district	
Akron, Ohio.....	35-100	55- 75	None
Albany, N. Y.....	90	45	None
Allentown, Pa.....	50- 55	50	None
Altoona, Pa.....	65	50	None
Atlanta, Ga.....	40- 60	60	10 lbs. ^a
Atlantic City, N. J.....	40	40	None
Augusta, Ga.....	70	70	None ^b
Baltimore, Md.....	40- 80	40-100	None
Bayonne, N. J.....	60- 70	60- 70	30 lbs.
Berkeley, Cal.....	35-125	15-175	None
Bethlehem, Pa.....	64	42	None
Binghamton, N. Y.....	55- 60	40- 50	10-15 lbs.
Birmingham, Ala.....	90-100	60- 80	None
Boston, Mass.....	55- 90	65	None
Bridgeport, Conn.....	60	50	None
Brockton, Mass.....	76	70	None
Buffalo, N. Y.....	50	30- 50	None
Cambridge, Mass.....	60	60	None
Camden, N. J.....	35	35	None
Canton, Ohio.....	65	55	None
Charlestown, S. C.....	35- 40	35- 40	None
Chattanooga, Tenn.....	65	45	None
Chester, Pa.....	79- 90	60- 65	None
Chicago, Ill.....	30	25	None
Cincinnati, Ohio.....	50	40	None
Cleveland, Ohio.....	35- 40	35- 40	None
Columbus, Ohio.....	57	49	10 lbs. Rarely
Covington, Ky.....	115	100	None
Dallas, Tex.....	65	30	None
Davenport, Iowa.....	60- 65	40-100	20-30 lbs.
Dayton, Ohio.....	65- 76	50- 70	None
Denver, Colo.....	55	50	15 ^c
Des Moines, Iowa.....	95	50	15 ^d
Detroit, Mich.....	28- 30	28- 30	None
Duluth, Minn.....	100	50- 75	None
East Orange, N. J.....	80	75- 80	None
E. St. Louis, Ill.....	50	40	None
Elizabeth, N. J.....	35	30	None
El Paso, Tex.....	80	60	None
Erie, Pa.....	65	65	None
Evansville, Ind.....	50	50	15-40 lbs.
Fall River, Mass.....	80	30- 55	None

Table of water pressure—Continued

CITY	NORMAL PRESSURE POUNDS PER SQUARE INCH		PRESSURE INCREASED FOR FIRE
	Commercial district	Residence district	
Flint, Mich.	50	50- 65	None
Ft. Wayne, Ind.	40	40	None
Ft. Worth, Tex.	70	25- 40	10 lbs.
Gary, Ind.	55	55	50 lbs.
Grand Rapids, Mich.	60- 90	30- 55	None ^a
Harrisburg, Pa.	70	40- 70	None
Hartford, Conn.	90	90	None
Haverhill, Mass.	38	57	None ^f
Hoboken, N. J.	50	45	50 lbs.
Holyoke, Mass.	65-105	70-110	None
Houston, Tex.	55- 60	50- 55	None
Huntington, W. Va.	90-100	90	None
Indianapolis, Ind.	42	42	30 ^a
Jacksonville, Fla.	60	60	40 lbs.
Jersey City, N. J.	45	45	50 lbs.
Johnstown, Pa.	75- 80	60- 70	None ^a
Kansas City, Kans.	90-100	30- 60	10-15 lbs. Rarely
Kansas City, Mo.	100	45	10-15 lbs. Rarely
Knoxville, Tenn.	45	45	50 lbs.
Lancaster, Pa.	55	30- 65	None
Lansing, Mich.	50	40	None ⁱ
Lawrence, Mass.	67	55- 60	None
Lincoln, Neb.	55- 60	55- 60	50 lbs.
Little Rock, Ark.	65- 95	25- 95	None
Long Beach, Cal.	75	45- 75	None
Louisville, Ky.	75	50	None
Los Angeles, Cal.	40- 70	60	None
Lowell, Mass.	60- 70	40- 60	None
Lynn, Mass.	65	55	None
Macon, Ga.	45- 60	25- 45	None
Manchester, N. H.	60	90	30 lbs.
Memphis, Tenn.	55- 60	50	None
Milwaukee, Wis.	50- 55	25- 50	None
Minneapolis, Minn.	75	60	None
Mobile, Ala.	81	81	None
Nashville, Tenn.	60-100	30- 80	None
Newark, N. J.	30- 70	30- 70	None ⁱ
New Bedford, Mass.	65- 90	30- 90	None
New Britain, Conn.	25-120	85	None
New Haven, Conn.	40	40	None
New Orleans, La.	60- 70	60- 70	None
New York, N. Y.	50	55	None

Table of water pressure—Continued

CITY	NORMAL PRESSURE POUNDS PER SQUARE INCH		PRESSURE INCREASED FOR FIRE
	Commercial district	Residence district	
Niagara Falls, N. Y.....	65- 70	60- 65	40 lbs. Rarely
Norfolk, Va.....	30	30	5-10 lbs.
Oakland, Cal.....	75	60	None
Oklahoma City, Okla.....	70	55- 75	None
Omaha, Neb.....	90	60	None
Passaic, N. J.....	70-90	50- 70	None
Patterson, N. J.....	60- 70	50- 60	None
Pawtucket, R. I.....	90	80- 90	None
Peoria, Ill.....	99	48	None
Philadelphia, Pa.....	25	25	15 lbs. Rarely
Pittsburgh, Pa.....	85- 90	55	None
Portland, Me.....	60-100	60	None
Portland, Ore.....	80- 90	60	None
Portsmouth, N. H.....	60	40	None
Providence, R. I.....	64- 72	15- 70	None
Racine, Wis.....	60- 70	50	None*
Reading, Pa.....	30- 66	60	None
Richmond, Va.....	20	60	15-25 lbs. ¹
Roanoke, Va.....	75	60	None
Rochester, N. Y.....	50	50	None
Rockford, Ill.....	65	65	15 lbs. Rarely
Sacramento, Cal.....	40	40	None
Saginaw, Mich.....	45	45	None*
St. Joseph, Mo.....	90-110	30- 60	10 lbs.
St. Louis, Mo.....	50	40	None
St. Paul, Minn.....	50- 65	40- 50	None
Salt Lake City, Utah.....	115	100-125	None
San Antonio, Tex.....	70	60	None
San Diego, Cal.....	75	50	None
San Francisco, Cal.....	50- 60	30- 80	None
Savannah, Ga.....	52	52	4 lbs.
Schenectady, N. Y.....	85	70	None
Scranton, Pa.....	90	80	None*
Seattle, Wash.....	80-120	40-120	None
Sioux City, Iowa.....	87-110	55- 75	15
Somerville, Mass.....	60- 95	50- 65	None
South Bend, Ind.....	65	55	20-30
Spokane, Wash.....	90	70	None
Springfield, Ill.....	35- 40	35	None
Springfield, Mass.....	140	80	None
Springfield, Ohio.....	75	65	None
Syracuse, N. Y.....	85- 95	35- 60	None

Table of water pressure—Concluded

CITY	NORMAL PRESSURE POUNDS PER SQUARE INCH		PRESSURE INCREASED FOR FIRE
	Commercial district	Residence district	
Tacoma, Wash.....	70	55	None
Tampa, Fla.....	58	55	40 lbs.
Terre Haute, Ind.....	45- 50	45- 50	55 lbs.
Toledo, Ohio.....	75	50- 60	None
Topeka, Kans.....	60	45	55 lbs.
Trenton, N. J.....	40	32	None
Troy, N. Y.....	60	60- 80	None
Tulsa, Okla.....	60	50	None ^m
Utica, N. Y.....	80-125	70	None
Washington, D. C.....	30- 50	30- 35	None
Waterbury, N. Y.....	110-120	110	None
Wheeling, W. Va.....	80- 90	60- 70	None
Wichita, Kans.....	50	40	20 lbs.
Wilmington, Del.....	32- 64	34- 57	None
Worcester, Mass.....	100-145	70-100	None
Yonkers, N. Y.....	100-120	60- 90	None ^e
Youngstown, Ohio.....	100	40	10 lbs.

- ^a Increased on special call above 10 pounds.
- ^b Increased for very large fire.
- ^c In Mercantile District.
- ^d In year 1921 raised pressure twice.
- ^e In case of large fire an extra pump.
- ^f High service in Mercantile District carries 107 pounds.
- ^g Are getting away from raising pressure as being dangerous.
- ^h Turn on more water to maintain 60 pounds.
- ⁱ Increase on special request of Fire Chief. None in a year.
- ^j In some cases maintain minimum of 40 pounds.
- ^k Formerly raised pressure—now motorized.
- ^l Increased in Mercantile District.
- ^m Can raise pressure 15-20 pounds.
- ⁿ Maintains adequate supply—rarely increase pressure.

The amount of the increase of pressure ranges from 4 pounds to 55 pounds. The average is 24 pounds.

In the larger cities such as New York, Philadelphia and Baltimore, high pressure hydrants supplied by separate high pressure mains are available in high value districts and that, of course, is good practice and will doubtless extend to other cities in time.

The Illinois Section of the American Water Works Association, the Indiana Sanitary and Water Supply Association and the Iowa Section of the American Water Works Association have adopted resolutions, which have been published,^{2,3} advocating the discontinuance of raising pressure during fires and it is strange that such a reasonable and apparently necessary reform was not started sooner.

² See *JOURNAL*, January, 1922, page 138.

³ See *JOURNAL*, July, 1922, page 601.